SCIENCE:

A WEEKLY RECORD OF SCIENTIFIC PROGRESS.

JOHN MICHELS, Editor.

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To Correspondents.

All communications should be addressed to the Editor—Box 3838, P. O., New York—with name and address of writer, not necessarily for publication without consent.

Scientific papers and correspondence intended for publication, should be written *legibly* on one side only of the paper. Articles thus received will be returned when found unsuitable for the Journal.

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Both questions and answers in "Notes and Queries" should be made as brief as possible; an answer appearing to demand an elaborate reply, may be written in the form of an article.

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CO-OPERATION IN SCIENCE.

At this season of rest and recreation, naturalists are now wandering on many a hill and dale or upon the breezy shore, intent on collecting specimens which shall employ their leisure hours in the Autumn and coming Winter. From the close precincts of a city, who would not be free and join the little band, who with nets, bottles, corks and pins, are now seeking things bright and rare, which Nature has so lavishly scattered, and yet with such a cunning hand, that even the search and gathering affords delight to those who diligently seek.

The number of collectors is steadily increasing, but when we contemplate the immense ground to be covered, the necessity for increasing the force becomes but too apparent. Not only have the depths of mighty oceans to be explored, and the bottom of great seas investigated; but also tiny denizens of little rock pools must be described and classified. The surface of the earth might seem too immense to be minutely examined by the naturalist, but still he has to descend many hundred feet into the bowels of the earth to there find records of past life, so as to complete the great catalogue of Nature's works.

Earth, air, and water have thus to be surveyed, and still another world of life and form which is invisible to the natural vision of man. These microscopic forms are not to be neglected, for they decimate populations and destroy the industry of nations, and are so numerous, that the accumulation of their countless numbers rear up mighty ranges of mountains.

With such a work before collectors who are hopefully struggling to add to our garner of a knowledge of Nature, who cannot desire that their number may be increased. Yet how easily it might be done. From the fact that some of our best collectors are not scientific men, it would seem that a convenient division of labor is here suggested, namely: the amateur who collects, and the scientist who describes and classifies. Some men possess special qualifications for collecting, they discover localities which others would never dream of, and they have a happy knack of always finding what they are in search of. Such expertness may be largely due to constant practice, but the professional scientist finds himself tied to his study and laboratory, and has no time for these constant perambulations; he must therefore largely rely on the amateur collector for his material, as the latter must depend on him, for his technical and scientific knowledge.

If therefore, there are two classes who are dependent upon each other for the extension of a great and valuable work, let that co-operation be more distinctly recognized and accepted, for such is far from being the case at the present time, particularly in the United States, where of all places it might be expected to thrive.

One of the best means of organizing an efficient corps of amateur workers, is the establishment of local scientific societies, and the circulation of moderate priced but strictly first-class scientific journals.

In Europe, and especially England, scientific societies, chiefly supported by amateurs, are now doing excellent work; but in the United States (with a few exceptions) they drag on a miserable existence of poverty and inutility. What is the cause of this? Simply a want of co-operation between the amateur and professional scientist, and a due regard for each other's position.

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To be effective, the officers and council of a scientific society should be taken from the best professional scientists in the neighborhood—men able to command and organize the work of the society, and give a

character and tone to its proceedings. The amateurs must constitute the rank and file, accept that position, and keep to it, until by some special qualifications they may be promoted to a higher grade.

In England such is the case. Taking the case of the Quekett Microscopical Society, such men as Professor Huxley, Dr. Lionel Beale and Dr. Cobbold, the eminent helminthologist, have presided over the proceedings, and the result has been that over five hundred members have enlisted under such leadership. Compare this with the American Microscopical Society of New York established in the same year. Who ever heard of a paper read before this body, or a single piece of scientific work performed by one of its members? No fossil could be more inactive than this society; it exists on paper only, and for the benefit of a few officials.

A younger Microscopical Society, established in New York city about three years since, has been organized on an equally faulty basis, and now numbers but thirty members. The co-operation of the right men has never been asked, and probably would not be accepted, and in consequence, a future of inactivity and embarassment may be anticipated.

To make American Scientific Societies as effective as those in England, they must be organized on a sufficiently popular basis, to interest the sympathy and support of the public; and presided over by men of known scientific ability, whose presence will encourage the student, and give a character to the proceedings.

In regard to the aid given by scientific journals in promoting useful co-operation between the scientist and the student, we may state that one of the objects of "SCIENCE" is to promote such a consummation, and that aim will be constantly kept in view. As a step in the right direction we have here indicated some of the means, by which the icy barrier which now separates those who should be cordially united in a great work, may be gently thawed by the inspiring influences of united action and generous co-operation.

A SCHOOL of agriculture has been formed at Canterbury, New Zealand, situated at Lincoln, twelve miles from the city of Canterbury. This institution is under the direction of Mr. W. E. Ivey, comprises lecture theatre, library, museum, chemical laboratory. A farm of 500 acres is attached to the institution, a portion of which will be devoted to experimental purposes for testing the various methods of cultivation.

M. DAUBREE, director of the French School of Mines, has published an essay on Descartes, in which he summarises the services rendered by that philosopher to science. He reminds his readers that Descartés advocated the theory of an igneous origin for the earth, and he enters into a lengthened discussion of the objections which may be raised against the theory of actual causes.

THE Earl of Spencer, in a recent speech in the House of Lords, *admitted* the application of science to agriculture. He said: "Great attention had of late years been very properly called to the great aid which science gave to the various classes of manufactures and producers; and that principle applied with quite as great force to agriculture as to any other art. If science could enable our agriculturists to produce more from the land than they had hitherto done, it would add another to the many useful things it had been the means of accomplishing." These words might, with some propriety, have been spoken twenty years ago, and if they represent the present relation of science to British agriculture, much of the unprofitable results of farming in that country may be thus explained.

LORD Spencer said, that it had been at last decided to open a class for agriculture next August, at the Department of Science and Art. We commend Lord Spencer to a perusal of the reports of the department of Agriculture at Washington, especially that for 1878, in which the value of science to the agriculturist is very evident.

THE value of scientific journals has been attested to, by the humble class of astronomers who exhibit their telescopes at corners of streets in Paris, showing the moon, planets and other celestial objects which may be seen with telescopes of moderate quality. They state that since the publication of the *Astronomie Populaire* the number of their customers has nearly doubled.

IT appears from a statement by M. Flammarion that the scientific journalists of Paris meet monthly, when papers are read, and other business transacted.

M. J. M. GAUGAIN, the eminent French electrician, recently died at the age of seventy years.

At a recent trial in England, a gas company was sued for damages, the plaintiff having been rendered insensible by an escape of the company's gas, due to a breakage in their mains. The plaintiff alleged that he suffered for a considerable length of time after the accident, and was unfit for business. The jury accepted the view of Dr. Tidy and Dr. Hastings, who gave scientific evidence on the subject, they being of the opinion that the effect of inhaling coal gas was very transitory; and that if sufficient was not inhaled to cause death, it would shortly pass from the system, and its ill effects cease.

CORRESPONDENCE.

To the Editor of Science:

DEAR SIR:—In the Physical Laboratory we noticed last Winter a beautiful experiment with vapors. An alcohol lamp, burning, was put under the receiver of the air pump. A few strokes put out the flame. The air returning, a single stroke of the piston caused the receiver to fill with a dense and transient cloud, soon disappearing with a change of pressure in the receiver. This experiment has interesting relations to rain fall, and other meteorological phenomena.

G. M. MANSFIELD.

Laboratory of Asbury University, Indiana, July 7, 1880.

A DARWINIAN STUDY.

By Alfred R. Wallace.

For the benefit of those unacquainted with entomology we may state, that many butterflies have two, or even three broods in a year. One brood appears in spring, their larvæ having fed during the preceding autumn, and passed the winter in the pupa state, while the others appear later in the year, having passed rapidly through all their transformations and thus never having been exposed to the cold of winter. In most cases the insects produced under these opposite conditions present little or no perceptible difference; but in others there is a constant variation, and sometimes this is so great that the two forms have been described as distinct species. The most remarkable case among European butterflies is that of *Araschnia prorsa*, the winter or spring form of which was formerly considered to be a distinct species and named *Araschnia levana*. The two insects differ considerably in both sexes, in markings, in color, and even in the form of the wings, so that till they were bred and found to be alternate broods of the same species (about the year 1830) no one doubted their being altogether distinct.

In order to learn something of the origin and nature of this curious phenomenon Dr. Weisman has for many years carried on a variety of experiments, breeding the species in large numbers and subjecting the pupæ to artificial heat or cold for the purpose of hastening or retarding the transformation. The result of these experiments is, that by subjecting the summer brood to severe artificial cold in the pupa state, it may be made to produce perfect insects the great majority of which are of the winter form, but, on the other hand, no change of conditions that has yet been tried has any effect in changing the winter to the summer form. Taking this result in connection with the fact that in high latitudes where there is only one brood a year it is always the winter form, Dr. Weismann was led to the hypothesis that this winter form was the original type of the species, and that the summer form has been produced gradually, since the glacial epoch, by the summer becoming longer and thus admitting of the production of a second or summer brood. This explains why the production of the winter form (*A. levana*) from summer larvæ is easy, it being a reversion to the ancestral type; while the production of the summer form (*A. prorsa*) from autumnal larvæ is impossible, because that form is the result of gradual development; and processes of development which have taken thousands of years to bring about cannot be artificially reproduced in a single season.

This hypothesis was supported by experiments with another two-brooded species, *Pieris napi*, with similar results, the winter form being produced with certainty by the application of cold to summer pupæ; and Mr. Edwards, in America, has made similar experiments with the various forms of *Papilii ajax*, finding that the summer broods can be changed into the winter form by the application of cold, while the winter broods can never be made to assume the summer form by hastening the process of transformation. In the Arctic regions and in the high Alps there is only one form of *Pieris napi*, which very closely resembles the winter form of the rest of Europe, and this could never be the least changed by rapidly developing the pupæ under the influence of heat.

Another curious case is that of one of the Lycænidæ (*Plebeius agestis*) which exhibits three forms, which may be designated as A, B, and C. The first two, A and B, are alternate broods (winter and summer) in Germany, while in Italy the corresponding forms are B and C, so that B is the summer form in Germany and the winter form in Italy. Here we see climatic varieties in process of formation in a very curious way.

That temperature during the pupa stage is a very powerful agent in modifying the characters of butterflies, is well shown by the case of *Polyommatus phlæas*. The two broods of this insect are alike in Germany, while in Italy the summer brood has the wings dusky instead of copper-colored. The period of development is exactly the same in both countries, so that the change must, it is argued, be attributed to the higher temperature of the Italian summer. It has been noticed that in Italy a large number of species of butterflies are thus seasonally dimorphic which are not so in Central and Northern Europe.

Dr. Weismann lays great stress on the varied effects of temperature in modifying allied species or the two sexes of the same species, from which he argues that the essential cause of all these changes is to be found in peculiarities of physical constitution, which cause different species, varieties, or sexes to respond differently to the same change of temperature; and he thinks that many sexual differences can be traced to this cause alone without calling in the aid of sexual selection. The general result arrived at by the laborious investigation of these phenomena is, that—"a species is only caused to change through the influence of changing external conditions of life, this change being in a fixed direction which entirely depends on the physical nature of the varying organism, and is different in different species, or even in the two sexes of the same species;" and he adds:—"According to my view, transmutation by purely internal causes is not to be entertained. If we could absolutely suspend the changes of the external conditions of life, existing species would remain stationary. The action of external inciting causes, in the widest sense of the word, is alone able to produce modifications; and even the never-failing 'individual variations,' together with the inherited dissimilarity of constitution, appear to me to depend upon unlike external influences, the inherited constitution itself being dissimilar, because the individuals have been at all times exposed to somewhat varying external influences." The present writer has arrived at almost exactly similar conclusions to these, from a study of the geographical distribution and specific variation of animal forms, as stated in an article on "The Origin of Species and Genera," which appeared in the *Nineteenth Century* of January last, and it is gratifying to find them supported by the results of a very different line of inquiry, and by the authority of so eminent and original an observer as Dr. Weismann.

A FOURTH STATE OF MATTER[1]

In introducing the discussion on Mr. Spottiswoode and Mr. Moulton's paper on the "Sensitive State of Vacuum Discharges," at the meeting of the Royal Society on April 15, Dr. De La Rue, who occupied the chair, good-naturedly challenged me to substantiate my statement that there is such a thing as a fourth or ultra-gaseous state of matter.

I had no time then to enter fully into the subject; nor was I prepared, on the spur of the moment, to marshal all the facts and reasons which have led me to this conclusion. But as I find that many other scientific men besides Dr. De La Rue are in doubt as to whether matter has been shown to exist in a state beyond that of gas, I will now endeavor to substantiate my position.

I will commence by explaining what seems to me to be the constitution of matter in its three states of solid, liquid, and gas.

I. First as to Solids:—These are composed of discontinuous molecules, separated from each other by a space which is relatively large—possibly enormous—in comparison with the diameter of the central nucleus we call *molecule*. These molecules, themselves built up of *atoms*, are governed by certain forces. Two of these forces I will here refer to—attraction and motion. Attraction when exerted at sensible distances is known as *gravitation*, but when the distances are molecular it is called *adhesion* and *cohesion*. Attraction appears to be independent of absolute temperature; it increases as the distance between the molecules diminishes; and were there no other counteracting force the result would be a mass of molecules in actual contact, with no molecular movement whatever—a state of things beyond our conception—a state, too, which would probably result in the creation of something that, according to our present views would not be *matter*.

This force of cohesion is counterbalanced by the movements of the individual molecules themselves, movements

[1] "On a Fourth State of Matter," in a letter to the Secretary of the Royal Society. By W. Crookes, F.R.S.

varying directly with the temperature, increasing and diminishing in amplitude as the temperature rises and falls. The molecules in solids do not travel from one part to another, but possess adhesion and retain fixity of position about their centre of oscillation. Matter, as we know it, has so high an absolute temperature that the movements of the molecules are large in comparison with their diameter, for the mass must be able to bear a reduction of temperature of nearly 300° C. before the amplitude of the molecular excursions would vanish.

The state of solidity, therefore—the state which we are in the habit of considering *par excellence* as that of *matter*—is merely the effect on our senses of the motion of the discrete molecules among themselves.

Solids exist of all consistencies, from the hardest metal, the most elastic crystal, down to thinnest jelly. A perfect solid would have no viscosity, *i.e.*, when rendered discontinuous or divided by the forcible passage of a harder solid, it would not close up behind and again become continuous.

In solid bodies the cohesion varies according to some unknown factor which we call chemical constitution; hence each kind of solid matter requires raising to a different temperature before the oscillating molecules lose their fixed position with reference to one another. At this point, varying in different bodies through a very wide range of temperature, the solid becomes liquid.

II. In liquids the force of cohesion is very much reduced, and the adhesion or the fixity of position of the centres of oscillating molecules is destroyed. When artificially heated, the inter-molecular movements increase in proportion as the temperature rises, until at last cohesion is broken down, and the molecules fly off into space with enormous velocities.

Liquids possess the property of viscosity—that is to say, they offer a certain opposition to the passage of solid bodies; at the same time they cannot permanently resist such opposition, however slight, if continuously applied. Liquids vary in consistency from the hard, brittle, apparently solid pitch to the lightest and most ethereal liquid capable of existing at any particular temperature.

The state of liquidity, therefore, is due to inter-molecular motions of a larger and more tumultuous character than those which characterize the solid state.

III. In gases the molecules fly about in every conceivable direction, with constant collision and enormous and constantly varying velocities, and their mean free path is sufficiently great to release them from the force of adhesion. Being free to move, the molecules exert pressure in all directions, and were it not for gravitation they would fly off into space. The gaseous state remains so long as the collisions continue to be almost infinite in number, and of inconceivable irregularity. The state of gaseity, therefore, is pre-eminently a state dependent on collisions. A given space contains millions of millions of molecules in rapid movement in all directions, each molecule having millions of encounters in a second. In such a case the length of the mean free path of the molecules is exceeding small compared with the dimensions of the containing vessel, and the properties which constitute the ordinary gaseous state of matter, which depend upon constant collisions, are observed.

What, then, are these molecules? Take a single lone molecule in space. Is it solid, liquid, or gas? Solid it cannot be, because the idea of solidity involves certain properties which are absent in the isolated molecule. In fact, an isolated molecule is an inconceivable entity, whether we try, like Newton, to visualise it as a little hard spherical body, or, with Boscovich and Faraday, to regard it as a centre of force, or accept Sir William Thomson's vortex atom. But if the individual molecule is not solid, *á fortiori* it cannot be regarded as a liquid or gas, for these states are even more due to inter-molecular collisions than is the solid state. The individual molecules, therefore, must be classed by themselves in a distinct state or category.

The same reason applies to two or to any number of contiguous molecules, provided their motion is arrested or controlled, so that no collisions occur between them; and even supposing this aggregation of isolated non-colliding molecules to be bodily transferred from one part of space to another, that kind of movement would not thereby cause this molecular collocation to assume the properties of gas; a molecular wind may still be supposed to consist of isolated molecules, in the same way as the discharge from a mitrailleuse consists of isolated bullets.

Matter in the fourth state is the ultimate result of gaseous expansion. By great rarefaction the free path of the molecules is made so long that the hits in a given time may be disregarded in comparison to the misses, in which case the average molecule is allowed to obey its own motion or laws without interference; and if the mean free path is compatible with the dimensions of the containing vessel, the properties which constitute gaseity are reduced to a minimum, and the matter then becomes exalted to an ultra-gaseous state.

But the same condition of things will be produced if by any means we can take a portion of gas, and by some extraneous force infuse order into the apparently disorderly jostling of the molecules in every direction, by coercing them into a methodical rectilinear movement. This I have shown to be the case in the phenomena which cause the movements of the radiometer, and I have rendered such motion visible in my later researches on the negative discharge in vacuum tubes. In the one case the heated lampblack and in the other the electrically excited negative pole supplies the *force majeure* which entirely or partially changes into a rectilinear motion the irregular vibration in all directions; and accordidg to the extent to which this onward movement has replaced the irregular motions which constitute the essence of the gaseous condition, to that extent do I consider that the molecules have assumed the condition of radiant matter.

Between the third and the fourth states there is no sharp line of demarcation, any more than there is between the solid and liquid states, or the liquid and gaseous states; they each merge insensibly one into the other. In the fourth state properties of matter which exist even in the third state are shown *directly*, whereas in the state of gas they are only shown *indirectly*, by viscosity and so forth.

The ordinary laws of gases are a simplification of the effects arising from the properties of matter in the fourth state; such a simplification is only permissible when the mean length of patch is small compared with the dimensions of the vessel. For simplicity's sake we make abstraction of the individual molecules, and feign to our imagination *continuous* matter, of which the fundamental properties—such as pressure varying as the density, and so forth—are ascertained by experiment. A gas is nothiug more than an assembly of molecules contemplated from a simplified point of view. When we deal with phenomena in which we are obliged to contemplate the molecules individually, we must not speak of the assemblage as *gas*.

These considerations lead to another and curious speculation. The molecule—intangible, invisible, and hard to be conceived—is the only true *matter*, and that which we call matter is nothing more than the effect upon our sense of the movements of molecules, or, as John Stuart Mill expresses it, "a permanent possibility of sensation." The space covered by the motion of molecules has no more right to be called matter than the air traversed by a rifle bullet can be called lead. From this point of view, then, matter is but a mode of motion; at the absolute zero of temperature the inter-molecular movement would stop, and although *something* retaining the properties of inertia and weight would remain, *matter*, as we know it, would cease to exist.

NOTE BY THE DUKE OF ARGYLE.

In the very interesting communication from Mr. Crookes on "A Fourth State of Matter," which is contained in *Nature*, vol. xxii. p. 153, there is a paragraph at the end which advances, as it seems to me, some most disputable propositions.

Like many other questions of modern science, the question he raises is to a very large extent a question of definition. But questions of definition are questions of the very highest importance in philosophy, and they need to be watched accordingly.

Speculating on the ultimate conceptions of Matter which are affected by the discovery of it in "a fourth condition," Mr. Crookes says: "From this point of view, then, Matter is but a "mode of motion.'"

It has never appeared to me that this well-known phrase is a very happy one, even as applied to Heat. It is possible, of course, to consider Heat from this point of view. But then it is equally possible to consider all other phenomena whatever from the same point of view. Not only Heat, but Light, Sound, Electricity, Galvanism, and Sensation itself in all its forms, may be regarded as "modes of motion."

But at least in the application of this phrase to Heat there is an intelligible meaning, and not a mere confusion of thought. But as applied to Matter—as a definition of our ultimate conception of matter—it appears to me to confound distinctions which are primary and essential. "Motion" is an idea which presupposes Matter and Space. Motion has no meaning whatever except the movement of Matter in Space. To define Matter, therefore, as a "mode of motion," is to define it as Matter in a state of motion. But this definition necessarily implies that Matter can also be conceived as without motion, and accordingly Mr. Crookes is obliged to confess that "at the absolute zero of temperature inter-molecular movement would stop," and that after that, Matter would remain with all the "properties of inertia and of weight."

Again Mr. Crookes says: "The space covered by the motion of molecules has no more right to be called Matter than the air traversed by a rifle bullet can be called lead." No doubt this is true; but it implies what is not true, that the common idea of Matter is nothing but "the space covered by the motion of molecules." The popular idea attached to words of primary significance may not be always adequate or complete. But in my opinion they are generally much more near the truth, and more accurately represent the truth than most of the phrases which scientists are now inventing in the region of transcendental physics.

These phrases have their value and their interest as representing special and partial aspects of phenomena. But I hold that the unconscious metaphysics of human speech are often the deepest and truest interpretations of the ultimate facts of nature

ON A NEW JELLY-FISH OF THE ORDER TRACHOMEDUSÆ, LIVING IN FRESH WATER.

On Thursday last, June 10, Mr. Sowerby, the Secretary of the Botanical Society of London, observed in the tank in the water-lily house in Regent's Park a peculiar organism, of which he was kind enough to place a large number at my disposal on the following Monday.

The organism proves to be an adult medusa belonging to the order Trachomedusæ and the family Petasidæ of Haeckel's system ("System der Medusen," Erster Theil). It comes nearest among described genera to Fritz Müller's imperfectly known *Aglauropsis* from the coast of Brazil.

The most obviously interesting matter about the form under notice is that it occurs in great abundance in perfectly fresh water at a temperature of 90° Fahr.

Hitherto no medusa of any order has been detected in fresh water—except perhaps some stray estuarine forms (Crambessa ?).

It is exceedingly difficult to trace the introduction of this animal into the tank in the Regent's Park, since no plants have been recently (within twelve months) added to the lily-house, and the water is run off every year. Probably a few specimens were last year or the year before present in the tank, and have only this year multiplied in sufficient abundance to attract attention. Clearly this medusa is a tropical species, since it flourishes in water of the high temperature of 90° Fahr.

Mr. Sowerby has observed the medusa feeding on Daphnia, which abounds in the water with it.

The present form will have to be placed in a new genus, for which I propose the name Craspedacusta, in allusion to the relation of its otocysts to its velum.

It is one of the sub-class Hydromedusæ or Medusæ craspedotæ, and presents the common characters of the order Trachomedusæ (as distinguished from the Narcomedusæ) in having its genital sacs or gonads placed in the course of the radial canals. It agrees with all Tracholinæ (Trachomedusæ and Narcomedusæ) in having endodermal otocysts, and it further exhibits the solid tentacles with cartilaginoid axis, the centripetal traveling of the tentacles, the tentacle rivets (Mantel-spangen), the thickened marginal ring to the disk (Nessel-ring) observed in many Tracholinæ.

Amongst Trachomedusæ, Craspedacusta finds its place in the Petasidæ, which are characterized as "Trachomedusæ with *four* radial canals, in the course of which the four gonads lie, with a long tubular stomach and no stomach-stalk."

Amongst Petasidæ it is remarkable for the great number of its tentacles, which are *all* solid; and for its very numerous otocysts. Further, it is remarkable among all Hydromedusæ (velate medusæ, that is, exclusive of Charybdæa) for the fact that centrifugal radiating canals pass from the otocysts *into the velum, where they end cæcally*.

The genus may be characterized as follows:

MOUTH quadrifid, with four per-radial lobes.

STOMACH long, quadrangular, and tubular, projecting a good deal below the disk.

DISK, saucer-shaped, that is, flattened.

RADIATING CANALS 4, opening into the marginal canal.

GONADS 4, in the form of 4 oval sacs, depending into the cavity of the subumbrella from the four radiating canals.

MARGINAL or RING CANAL voluminous.

CENTRIPETAL CANALS (such as those of Olindias, Geryonia, etc.) absent.

TENTACLES solid; in three sets, which are placed in three superimposed horizons:—

1. A set nearest the aboral pole, of 4 large per-radial tentacles. These are the *primary* tentacles.
2. A second tier of (in large specimens) 28 medium-sized tentacles placed between these in four groups of seven. These are the *secondary* tentacles.
3. A third tier of (in large specimens) 192 small tentacles placed in groups of six between adjacent secondary tentacles. These are the *tertiary* tentacles.

TENTACLE-RIVETS (Mantel-spangen) connecting the roots of the tentacles with the marginal ring (Nessel-ring) are connected with all the tentacles of each of the three horizons.

OTOLITHS placed along the line of insertion of the velum—about eighty in number (fewer in small specimens). From sixteen to twenty are placed between successive per-radial tentacles arranged in groups of two or three between the successive secondary tentacles.

VELAR CENTRIFUGAL CANALS (which are really the elongated otocysts) are peculiar to this genus, passing from the otoliths (one inclosing each otolith) into the velum, and there ending blindly. They appear to correspond in character to the *centripetal* canals found in other Trachomedusæ in the disk.

OCELLI are absent.

[The presence of velar otocystic canals constitute the chief peculiarity of the genus Craspedacusta, and may necessitate the formation of a distinct family or sub-order for its reception. The minute structure of the otoliths and canal-like otocysts I am now engaged in investigating.]

The above characters are derived from the examination of *adult* male specimens, which were freely discharging ripe, actively motile spermatozoa.

The species may be known as CRASPEDACUSTA SOWERBII, nov. gen. et sp.—I name the species in honor of Mr. Sowerby, who discovered it, and to whose quick observation and courteous kindness zoologists are indebted for the knowledge of this interesting animal.

The sole character which I can give as specific over and above the generic characters summarized above is that of size. The diameter of the disk does not exceed one-third of an inch.

Locality.—The water-lily tank in the gardens of the Botanical Society, Regent's Park, London.

Very abundant during June, 1880. Probably introduced from the West Indies. E. RAY LANKESTER.

—*Nature*.

EVOLUTION OF LOCOMOTIVES IN AMERICA.

The question of priority in the use of the locomotive on railroads in this country is one of perennial interest. The literature on the vexed subject cemprises volumes. For the seven cities of Greece, which claim the honor of the birthplace of Homer, we have had almost as many States claiming the honorable distinction of first introducing the locomotive engine for service on the railroad. The idea of applying steam as the motive power on railroads had occurred to many of our engineers, stimulated as they were doubtless by the successful practice of England; and the introduction of the locomotive by Pennsylvania and South Carolina was almost synchronous; yet the former is fairly entitled to the distinction of priority,

Fortunately there is now living in San Francisco one of the veteran railroad men of the country, who is absolutely familiar with the interesting incidents of the early history of the railroad and the locomotive engine in this country.

The testimony adduced from these intelligent and trustworthy sources is absolutely conclusive; and it would seem that it ought to end the controversy about the claim to priority in the first practical use of the locomotive engine in this country.

1. The first locomotive engine placed and tried on any railroad in America was called the "Stourbridge Lion," and was imported from England for the Delaware and Hudson canal and railroad company. This engine arrived in New York May 17, 1829, and was set up in the yard of the West Point foundry machine shops and publicly exhibited for days to thousands of the first citizens of the country. It was brought from England by Horatio Allen, who made the first experimental trial of it at Honesdale, on the banks of Lackawaxen creek, Pa., August 8, 1829, when he "opened the throttle valve of the locomotive engine that turned the first driving wheel on an American railroad." This highly interesting statement was made by Mr. Allen in a speech delivered at Dunkirk on the occasion of the celebration of the New York and Erie railroad.

2. The first locomotive built in America for a purely experimental purpose was the "Tom Thumb," which was constructed by the now venerable Peter Cooper. This little machine was built for the purpose of testing the feasibility of a locomotive sustaining itself while running over curves, which was a mooted point among the engineers and scientists of that day. The engine weighed less than a ton, the cylinder was only three and a half inches in diameter, the boiler was about as "large as an ordinary kitchen boiler," and was vertical, with gun barrels for tubes. The first trial was made on the Baltimore and Ohio railroad, from the depot at Baltimore to Ellicott's mills, August 28, 1830.

3. The first locomotive built in America for actual service on a railroad was called the "Best Friend," and was constructed for the Charleston and Augusta railroad company. This pioneeer locomotive was built at the West Point foundry machine shops in New York City, and the work of fitting it up fell to the lot of Mr. Matthew. Immediately after the engine was completed it was placed on the company's road, and the first experiment with a train was made November 2, 1830, N. W. Darrell acting as engineer.

Some few days previous to the above date, or about the 20th of October, in accordance with a notice given in the Charleston papers, a public trial was made without any cars attached. It was on this occasion that the first American built locomotive turned its wheels for the first time on a railroad track. At the trial on November 2d the wooden wheels of the machine, which were constructed after the English practice, sprung and got off the track; but they were replaced by cast iron wheels, and on December 14th and 15th the engine was again tried and ran at the rate of 16 to 21 miles an hour with five cars carrying about 50 passengers, and without the cars it attained a speed of 30 to 35 miles an hour. In the Charleston *Courier*, March 12, 1831, there is an account of a later trial of speed of the "Best Friend," on which occasion, the writer remarks: "Safety was assured by the introduction of a barrier car, on which cotton was piled up as a rampart between the locomotive and the passenger cars." The second locomotive for service built in this country was called the "West Point," and was for the same road. It was also constructed at the West Point machine shops.

4. The first locomotive built in America for a northern road was called the "De Witt Clinton," and was the third American locomotive. It was for actual service on the Mohawk and Hudson railroad. This engine, like the others, was built at the West Point machine shops, and was also fitted up by Mr. Matthew; and when it was completed he took it to Albany, June 25, 1831, and made the first excursion with a train of cars over the road August 9, 1831. According to Mr. Matthew's statement, the "De Witt Clinton" weighed 3½ tons, and hauled a train of 3 and 5 cars at the speed of 30 miles an hour. It is especially noteworthy that both the cab and the tender of the "De Witt Clinton" were covered to protect the engineer from the weather—a "happy thought" of honest David Matthew, for which all American engineers at least ought to hold him in kind remembrance. About the middle of August the English locomotive, "Robert Fulton," built by the younger Stephenson, arrived and was placed on the Mohawk and Hudson road for service in the middle of the following September.

These locomotives had been used and fairly tested both on the southern and northern railroads, and the necessity for a radical change in their construction had become evident. Very soon John B. Jervis devised the plan of putting the truck under the forward part of the engine to enable it to turn sharp corners easily and safely. The machine so constructed was called the "bogie" engine. The first of these engines ever built was for the Mohawk and Hudson road, and was called the "Experiment." It was put on the road and ran by Matthew, who says it was as "fleet as a greyhound. The "Experiment" had been built to burn anthracite coal solely; after a while it was rebuilt and adapted to the use of any kind of coal, and its name was changed to the "Brother Jonathan." Shortly after these changes had been made the English locomotive "Robert Fulton," belonging to the same company, was also rebuilt and furnished with the truck, and named the "John Bull." The "Brother Jonathan" was a remarkable machine for those pioneer days. Mr. Matthew says of it: "With this engine I have crossed the Mohawk and Hudson railroad from plane to plane, 14 miles, in 13 minutes, stopping once for water. I have tried her speed upon a level, straight line, and have run a mile in 45 seconds by the watch. She was the fastest and steadiest engine I have ever run or seen, and I worked her with the greatest ease." This is certainly wonderful speed, and may be, as Matthew earnestly maintains it is, the fastest time at least on the American railroad record.

In comparison to the splendid and efficient engine of today, our first locomotives, built after the English model mainly, were clumsy and crude machines. Since then our improvements have been manifold and extraordinary, and the American locomotive is now pronounced the most "perfect railroad tool in the world." Its exquisite symmetry and flexibility, and its extraordinary powers must fill the mind of a veteran like Matthews—who has watched its growth from its infancy in this country—with feelings of generous admiration and pride. The English and American railroads and locomotives are strikingly contrasted by a writer in *Harper's Magazine* for March, 1879. English roads are short, solid, straight and level, and laid with the best rails in the world; and their massive and powertul, and rigid-framed engines are thoroughly adopted to those perfect roads. On the contrary, the American road is generally of great length, and being necessarily cheap it "goes as you please." Over these eccentric roads the American locomotive adjusts itself to every change of level both across and along the line; it takes curves that would be impossible for the rigid English engine; and, finally, it runs over a crazy track, up hill and down, in perfect safety. It has been well said that all that the English engine can do on a perfect road the American engine will do; and much more than this, it will do work on any road, however rough, hilly, curved and cheap. The name of the first American locomotive seems to have been inspired, for it has in the largest sense proved our "Best Friend."—*Cal. Scientific Press.*

LITERARY INTELLIGENCE.

We have received *The Microscopist's Annual* for 1879, published quite recently and dated 1880. It contains useful tables, rules, formulæ and memoranda, a list of microscopical societies, with officers, etc.; Directory of prominent microscope makers, dealers and importers in America and Europe. We trust that microscopists will patronize this thoroughly practical little work, and as it is issued by the Industrial Publishing Company, of Dey street, New York, at the nominal price of twenty-five cents, its expense can hardly be a bar to its purchase. We understand future numbers will be considerably enlarged.

THE announcement is made of a new bi-monthly magazine called *The Educational Review*, which will be devoted to the science and philosophy of education, in all its departments of thought and discussion. It will be conducted by Mr. Thomas W. Bicknell, whose great experience in educational literature cannot fail to make it a success, and worthy of the great subject it takes in hand.

GENERAL NOTES.

THE French journal, *La Lumiere Electrique*, is to receive the addition of a supplement (having separate pagination) in which will be given a *résumé* of recent discoveries and inventions. For the present, these supplements will be confined to the subject of electric lighting.

IN a new form of telephone-receiver brought before the French Academy by M. Ader, two plates are used, arranged in such a manner that the air can pass through a central hole in one to the other. The result is, much louder tones, the second plate acting as a sort of soundboard.

THE Corporation of Yale College have established a horological laboratory in connection with the Winchester Observatory, with the view of encouraging the manufacture of more refined apparatus for the measurement of time.

IT is reported that Mr. Swan, of Newcastle-on-Tyne, has succeeded in rendering his little electric lamp a success. He uses a carbon thread in a vacuum tube, which supplies a soft and steady light, well adapted for household purposes.

M. DU MONCEL has just published a third edition of his work, entitled "Le Telephone, le Microphone, et le Phonographe," the two previous editions (containing 5,500 copies each) having been exhausted in fifteen months. The numerous recent developments of the telephone and microphone are described, and 48 new engravings are added. The phonograph seems to have made but little progress since its appearance; M. Du Moncel, however, specifies a few improvements of it.

THE House of Lords' Committee have passed the preamble of the Bill for the construction of a subway available for all kinds of traffic, vehicular and passenger, under the Mersey, so as to connect the towns of Liverpool and Birkenhead. The total length will be 1 mile 6 furlongs 6½ chains, and the estimated capital required £500,000, the taking up of which is guaranteed by the Corporations of Liverpool and Birkenhead, the Mersey Dock Board, and the Great-Western Railway, each of whom are prepared to give security for one quarter the cost of construction. The engineers are Mr. John Fowler, of London, and Messrs. Law and Thomas, of Wrexham.

IN a recent note to the Paris Academy, Professor Marangoni gives the results he has arrived at in a study of the swimming-bladder of fishes. He states, first, that it is the organ which regulates the migration of fishes, those fishes that are without it not migrating from bottoms of little depth, where they find tepid water; while fishes which have a bladder are such as live in deep, cold water, and migrate to deposit their ova in warmer water near the surface. Next, fishes do not rise like the Cartesian diver (in the well-known experiment), and they have to counteract the influence of their swimming-bladders with their fins. If some small dead and living fishes be put in a vessel three-quarters full of water and the air be compressed or rarefied, one finds in the former case the dead fish descend, while the living ones rise, head in advance, to the surface. Rarefying has the opposite effect. Fishes have reason to fear the passive influences due to hydrostatic pressure; when fished from a great depth, their bladders are often found to be ruptured. Thirdly, the swimming-bladder produces in fishes twofold instability—one of level, the other of position. A fish, having once adapted its bladder to live at a certain depth, may, through the slightest variation of pressure, be either forced downwards or upwards, and thus they are in unstable equilibrium as to level. As to position, the bladder being in the ventral region, the centre of gravity is above the centre of pressure, so that fishes are always threatened with inversion; and, indeed, they take the inverted position when dead or dying. This double instability forces fishes to a continual gymnastic movement, and doubtless helps to render them strong and agile. The most agile of terrestrial animals are also those which have least stability.

A new process of extracting sugar from molasses has been proposed by M. Gayon. It is based on the destruction of the glucose of molasses by fermentation; the sugar remains unaltered, and is obtained by ulterior crystallization. The ferment employed is a pretty common mould, *Mucor circinelloides*. M. Van Tieghem found it in horsedung, and was the first to describe it. The ferment cells must not be confounded with those of beer-yeast, or *saccharomyces*. They differ in form, and, unlike beer-yeast, this *mucor* is powerless to produce glucosic and alcoholic fermentations of cane-sugar, whereas it acts like all alcoholic yeast on glucose and similar compounds. If, then, the cells of *mucor* be sown in a nutritive solution of cane-sugar and glucose, the latter alone ferments, the sugar remaining unaltered, whereas with beer-yeast *all* ferments. This conclusion was confirmed indirectly by experiments made with a view to ascertain the constitution of the inactive glucose of molasses by saccharimetric observation. M. Gayon has succeeded in fermenting 200 or 300 c.c. of molasses solution, and he remarks that by combining the process with osmosis one might, no doubt, extract, in the dry crystalline state, all the sugar which the glucose and the salts retain in molasses. (The Editor of the *Journal de Pharmacie* observes that it is only exceptionally that glucose exists in molasses in sensible proportion, and it is the salts that prevent crystallisation of the sugar; nevertheless, M. Gayon's researches are of much interest scientifically.)

THE blood of most slaughter-houses is usually dealt with in a primitive manner in open air, and without previous disinfection. This is obviously opposed to hygienic and economic laws. M. Vautelet has lately brought forward a process of treating all organic detritus from slaughter-houses for agricultural purposes. He uses sulphate of alumina, sulphuric acid, and nitric acid in fixed proportions. By addition of sulphuric acid to sulphate of alumina a bisulphate is formed, which, less soluble than the sulphate, quickly causes a complete coagulation of the blood. The *rôle* of the nitric acid is coagulation of the albumin of the blood and formation of nitrate. The matters are thus disinfected, and their fertilising power fully preserved.

THE geological changes which the English Channel has undergone are discussed in a recent communication to the French Academy by M. Hebert (June 7).

SATURDAY, JULY 24, 1880.

THE SOCIETY OF AMERICAN TAXIDERMISTS.

BY WM. T. HORNADAY.

It is high time that the art of taxidermy should receive a new impetus from some source, if it is ever to rise above the level of an undignified, and rather unattractive trade. It is by no means universally looked upon as a fine art, it is certainly not patronized as such, and, until it is developed to a far higher state of perfection than it is at present, we are by no means sure it deserves to be. At present most taxidermists are fiercely jealous of each other and outsiders, and guard their little knowledge as a miser hoards his gold; and yet not a single taxidermist in America earns a competence, and no other position when once lost in one place is so hard to obtain in another. Taxidermists are agreed upon one point, and only one, viz.: that their art is one requiring as much anatomical knowledge and executive skill as either painting or sculpture, while each man, with but few exceptions is firmly convinced past all argument that *his* work is equalled by few and surpassed by none.

At present, taxidemy is not a popular art; as a profession, it is remunerative to the select few only, and even to those in a very moderate degree. But such results are but merited, and for this taxidermists have themselves to thank. If painters and sculptors had always been as narrow-minded, jealous, and absurdly exclusive of their knowledge as we have ever been (with but few exceptions) their art would stand no higher to-day than ours. I have known of taxidermists, who, when visited by other members of the profession, would invariably stop working the moment the visitor appeared and remain idle during his entire stay even though their specimen *spoiled*. Such men must think they are the only taxidermists in the world.

A great artist of any other description is ever ready and anxious to *learn*, even from the meanest sources sometimes; but your taxidermist soon knows too much to be taught anything by anybody, and to offer him any advice, or make an unfavorable criticism is to insult him. As a rule he refuses to teach his art to anyone, save at most fabulous prices. As a result of all this, taxidermy is not a popular art and not a tithe of its capabilities have yet been developed. Taxidermists have never combined to build up their art; from the very foundation, there have been no exhibitions, no well directed competition, no intelligent verdict as to the merits of this man or that, no interchange of ideas, no general and hearty dissemination of knowledge bearing upon this subject. The knowledge of the art is confined to a few, and so is the patronage.

The Society of American Taxidermists, the first of the kind ever organized, has been formed for the avowed purpose of developing the art of taxidermy, and elevating it to the position it should occupy beside the kindred arts of painting and sculpture. It has been formed not for the benefit of a few individuals, but with the higher, broader purpose of developing the possibilities of the art, and raising it to the level of a dignified and justly remunerative profession. Its members are practical, determined men who enter upon the work before them with all professional jealousy laid aside, and with the determination to work as one man. They propose to diffuse as widely as possible a correct knowledge of the methods employed in taxidermy, and by their work to create in the public a proper appreciation of their art as such. They believe that by combination, sharp but well regulated competition, and a few years of patient, earnest work and self improvement they will, in a measure, accomplish their object.

The Society has been started by the professional taxidermists in Prof. Ward's famous establishment at Rochester, N. Y., and already includes many well-known specialists in every branch of the art. It has received most cordial letters of encouragement and endorsement from such eminent scientists and patrons of taxidermy as Prof. Henry A. Ward, of Rochester, Prof. J. A. Allen, of Cambridge, Dr. Elliott Coues, of the Smithsonian Institution, and Dr. G. E. Manigault, of Charleston, S. C. Each of the above-mentioned gentlemen is an Honorary Member of the society.

The organization is steadily attracting candidates for membership from various parts of the United States, liberal minded professionals, and ambitious and enterprising amateurs who are only too glad of so fair an opportunity to follow up an attractive art.

The Society is to be national in all respects, and it is to be hoped it will yet wield an influence which will be felt in foreign countries. Indeed its members look forward to the day when there may be held under its auspices in this country a grand international exhibition of works in taxidermy.

The Society proposes to hold its first annual meeting and exhibition in the city of Rochester, on or about Dec. 20th of this year, at which a corps of carefully selected judges shall critically examine the objects in the exhibition and award the honors. Of course the judges will not be ordinary members of the society, and absolute fairness will be guaranteed. The objects entered for the exhibition will be divided into the following classes, which embrace work in every branch of the art:

A. TAXIDERMY PROPER.

First—Stuffed mammals, birds, reptiles and fishes, in groups.

Second—Single specimens.

Third—Heads. (Special attention is requested to the artistic arrangement of heads, especially those of small animals).

Fourth—Skins of all kinds.

Fifth—Crustaceans, in groups.

B. MISCELLANEOUS OBJECTS.

First—Animals grotesquely mounted.

Second—Ornamental articles, in which only portions of an animal are used, as fans, feather work, fire screens, rugs, footstools, etc.

President, Frederic S. Webster; Secretary, Wm. T. Hornaday. Office of the Secretary, 19 Rowley St., Rochester, N. Y.

C. ADJUNCTS TO TAXIDERMY.

Tools, eyes, materials, perches, leaves, rock-work, etc.

Already a large number of important objects are entered for exhibition, consisting chiefly of artistic groups, both large and small, and it is certain that there will be a fine display in class B, or household ornaments and decorations, most of which will be entirely new and original in design. A silver medal will be awarded to the finest single exhibit, a bronze medal to the best general exhibit, and a diploma of honor to the best exhibit in each of four natural classes, viz.: Mammals, birds, reptiles and fishes. A number of interesting papers and notes upon the various methods of taxidermy will be read at the general meeting and afterwards published in a volume as the proceedings of the society. From now until December each member will be busily engaged in putting forth all his skill and knowledge in the effort to win some of the honors offered for the highest excellence.

It is to be earnestly hoped that their vigorous and already successful movement will meet the hearty approval and co-operation of all American taxidermists, both amateur and professional, and that they will, by joining the society, and taking active part in the meetings and exhibitions, help to build up a powerful and influential organization, which is devoted to their best interests. The most unskillful amateurs are cordially welcomed as members, if they are but earnest in taking hold of the work in hand. It now remains to be seen how much liberality of mind, enthusiasm of purpose and ambitious enterprise will be awakened by this movement among American taxidermists.

DESCRIPTION OF SOME MONSTROSITIES OBSERVED IN NORTH AMERICAN COLEOPTERA.[1]

BY HORACE F. JAYNE.

The accumulation of material in some of the larger collections of Coleoptera of our fauna has suggested that a description of the more marked monstrosities might be interesting, and aid at some future time in throwing light on points of development not yet understood. I have, therefore, in this paper, described and figured those monstrosities which M. Mocquerys of Rouen, in his excellent work on Abnormal Coleoptera, calls "Monstrosities by Excess." Deformities by deficiency or incomplete development have not been considered as they do not seem of sufficient importance, and point only to accidents happening to the insects while in the larvæ or pupæ stage.

I desire to return my sincere thanks to Dr. Horn for the free use of his collection and library, for many suggestions and for kindly revising these pages; also to Dr. LeConte for the loan of specimens from his cabinet, and to Dr. Hagen for the use of specimens belonging to the Museum of Comparative Zoology at Cambridge.

[1] A paper read before the Am. Ent. Soc., June, 1880.

CALOSOMA TRISTE, Lec.

Fig. 1 represents a monstrosity on the right antenna of a specimen of *Colosoma triste*, Lec. It consists in the sixth joint bearing two branches of five joints. Fig. 1a, shows the antenna greatly enlarged. The first three joints are normal; the third a little dilated at apex. The fourth is normal in length but is one-half broader at apex. When viewed from above it is distinctly pyriform. The fifth joint is also of normal length but twice the width of that of the left side and slightly broader at apex. The sixth joint is pentagonal in form, in its widest place as wide as long. The apex is obliquely truncate on its inner and outer angles, presenting two unequal faces for the insertion of the two branches. The inner or posterior facet is much smaller and from it arises that branch with the joints exactly resembling the normal antenna. The anterior or outer facet is larger and gives insertion to an anterior or outer branch of five joints; the first being short and thick the others similar to the corresponding normal joints but smaller.

The specimen is in Dr. Horn's Cabinet. Collected in California.

CYCHRUS ANGUSTICOLLIS, Fisch.

Fig. 2 represents the deformed left anterior leg of a specimen of *Cychrus angusticollis*. The femur is greatly dilated a little beyond the middle and gives off from its superior border a tubercle moderately long and blunt at tip. This may possibly indicate an attempt at the development of a second leg. The femur is then narrowed and at apex is a little larger than the apex of the normal joint. The existence of a cotyloid cavity shows the former presence, and accidental loss of the tibia.

In the Museum of Comparative Zoology at Cambridge.

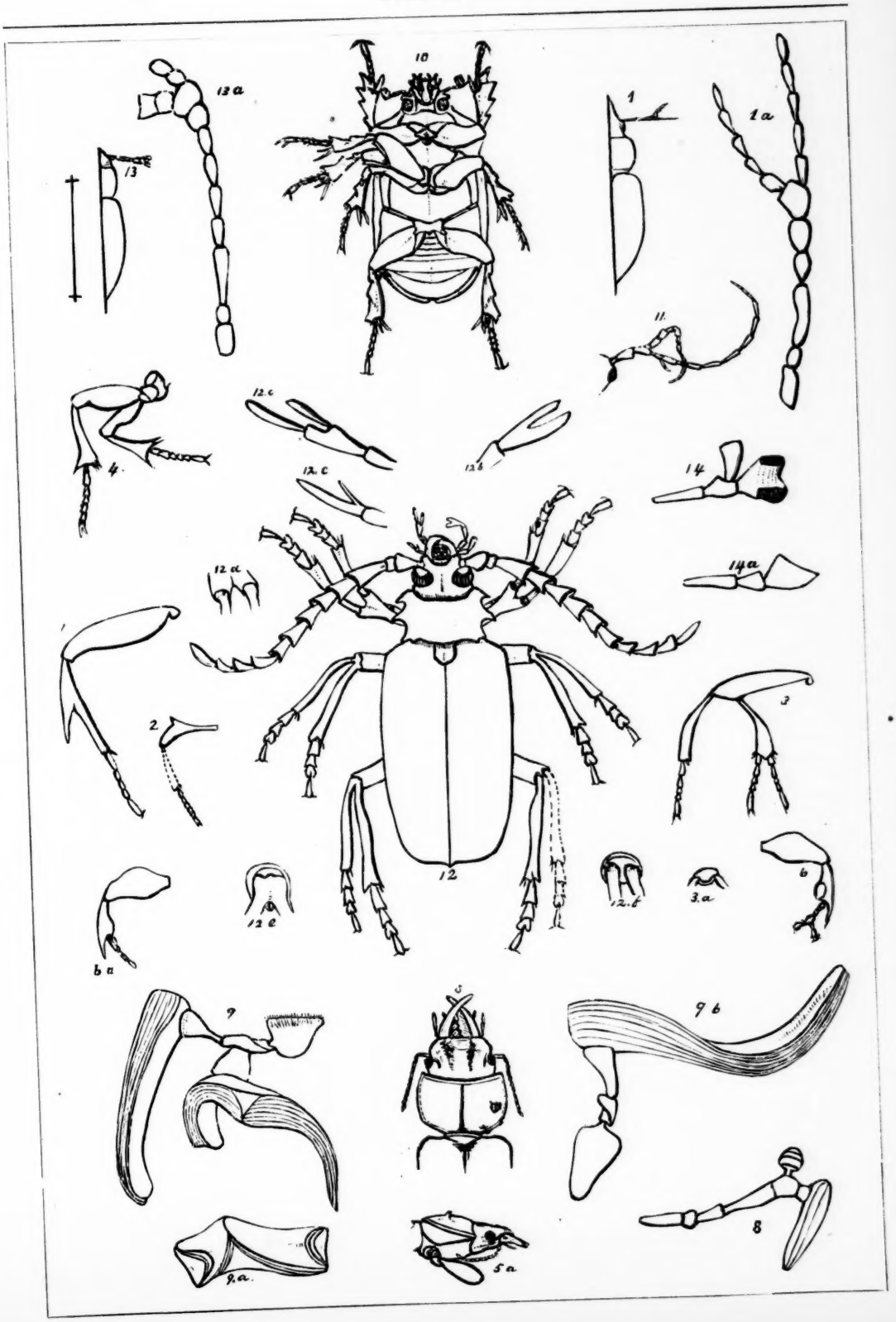
METRIUS CONTRACTUS, Esch.

A monstrosity in the middle left leg of a specimen of *Metrius contractus* is shown in fig. 3. The femur bears two tibiæ; the inner one bearing two full sets of tarsal joints. The femur is normal. The outer tibia, which may be regarded as the normal one, arises from the extremity of the femur and is somewhat shorter, stouter, and more curved than the tibia of the middle right leg. The inner tibia arises from the posterior side of the femur a short distance within the tip and is articulated with it by a separate cotyloid cavity, the two cavities however are confluent as seen in fig. 3a. It is distinctly arcuate, dilated toward the apex which is obliquely truncate at each angle. From each facet thus formed arises a tarsal joint of normal length, almost contiguous at their bases, and somewhat stouter than the succeeding joints which are normal in form but shorter than those of a normal tarsus. There are four terminal spurs to this tibia, two placed external to the outer tarsus, two within the inner.

In Dr. Horn's Collection.

PASIMACHUS PUNCTULATUS, Hald.

A specimen of *Pasimachus punctulatus* has seven legs; the extra one arising from a trochanter placed between the normal trochanter and femur of the left


10
13a
13
1
1a
11
4
12.c
12.b
14
12.c
14a
12.a
2
3
12
12.e
12.f
3.a
6
6a
9
9b
9a
5
5a
8

middle leg. Fig. 4 represents the anomaly as seen from below. The coxa and trochanter are like those of the right leg. On the inferior surface, between the trochanter and femur and embraced in front and behind by the latter, is inserted a second trochanter; triangular in form, about half as wide and one-third as long as the normal one. It gives origin to the extra femur, which is two thirds as long and about three-fourths as stout as the main thigh. The tibia of this extra femur is perfect except that it is one-fourth shorter than the other; its spurs and tarsal joints and the claws of the latter being all normal. This abnormal leg is less chitinous than the others.

In Dr. Horn's Collection.

SCARITES SUBSTRIATUS, Hald.

I have tried to represent in fig. 5a monstrosity on the right side of the dorsal surface of the prothorax in a specimen of the *Scarites substriatus*. It consists of a tubercle about a thirty-second of an inch long, projecting outward and slightly forward. It arises a thirty-second of an inch transversely from the middle of the right margin of the thorax. It is deeply cleft on the summit, almost transversely. Fig. 4a, represents it when viewed from the side.

Collected in Texas. In Dr. Horn's Cabinet.

DYSCHIRIUS GLOBULOSUS, Say.

The anomalous right anterior leg of a *Dyschirius globulosus* is shown in fig. 6. Fig. 5a, represents the normal right leg. The deformity consists in the third joint of the tarsus bearing two branches of two joints each. The inferior terminal spur of the tibia is wanting. The first two joints of the right tarsus are normal; the third a little longer, more clavate, and obliquely truncate on each side at tip for the articulation of the double set of joints which follow. The two anomalous branches arise on each side of the sharp apex thus formed, one directed to the left, the other to the right. The first joint on each branch is a shorter and stouter than a normal fourth joint; while the terminal or claw joint does not differ greatly in length. The claw joint of the inner or left branch bears a pair of normal claws, the outer claw joint is somewhat broader and bears two sets of claws curved from each other.

In Dr. LeConte's Cabinet.

CHLÆNIUS DIFFINIS, Chaud.

Fig. 7 represents a deformity in the left middle leg of a specimen of *Chlænius diffinis*. The tibia at a point a little below the middle bifurcates, the inner bifurcation continuing to normal length bears the tarsal joints. The outer is about two-thirds as long as the inner. It appears from its size and form that this branch bore a set of tarsal joints similar to those seen on the inner; and this opinion is strengthened by the fact that the end is somewhat ragged and seems to have been broken off.

In Dr. Horn's Cabinet.

LICHNANTHE VULPINA, Hentz.

A specimen of this insect has an anomalous right antenna as shown in fig. 8. The first three joints are normal. The fourth, fifth, and sixth are fused into one joint twice as long as the third; the seventh appears to be connate with the first joint of the club. From the posterior outer border of the long fourth joint near the tip there arises a spherical club of three joints about the length of the third antennal joint. The first joint comprising the pedicle and base of the club, the second the centre, and the last the apex.

In Dr. Horn's Cabinet.

POLYPHYLLA DECEMLINEATA, Say.

Fig. 9 represents the right antenna of a specimen of *Polyphylla decemlineata* in which, in addition to the normal structure, the second joint bears a branch anteriorly, consisting of a single free joint which supports two clubs, placed transversely to the normal, of seven lamellæ each, united at their bases. The plane of the normal club is perpendicular to the plane of the abnormal, but in the figure the two are represented as in the same plane; the normal branch as seen from the outer side, the abnormal as seen from above. Fig. 9b, represents the left antenna. The basal joint of the right antenna is somewhat smaller and more inflated than that of the left. The second joint is twice as long as the corresponding one on the left antenna; the outer half of the anterior border being flattened for the insertion of the first joint of the abnormal branch, and its posterior border somewhat sinuate near the tip. The double club on the abnormal branch consists of two sets, of seven lamellæ each of unequal size, united at their bases at an angle of forty-five degrees, the outer scarcely longer than half the inner and more curved, while the inner is but little shorter than the club of the normal branch but more curved than it. The joint supporting these branches is obconical and much shorter than the second joint from which it arises. Fig. 9a, represents the double club as seen from below. The third joint of the normal or posterior branch is in form like that of the left antenna, but a fifth shorter. It bears a club of seven lamellæ, which is directed downward, and is about half as long as that of the left side, much narrower and feebly curved.

The insect is in Dr. LeConte's Cabinet.

STRATEGUS ANTÆUS, Fabr.

A specimen of this insect has the left middle leg triplicated. I have tried to represent this monstrosity in fig. 10. It may be regarded as made up of a normal leg with its trochanter entire. To the under surface of this normal femur are added two others, making together a pyramidal mass; free at their apices for about one-third their length. Those of the normal femur and the one nearest to it are closely placed, while the other diverges at an angle of about forty-five degrees. Each femur is provided with a tibia and tarsus. The tibia of the normal femur is not as greatly developed as the corresponding one on the right leg and those on the two abnormal femora are still less strongly marked.

In the Museum of Comparative Zoology at Cambridge.

TELEPHORUS ROTUNDICOLLIS, Say.

A specimen of this insect is deformed in the right antenna as shown in fig. 11. The third joint bears

from its anterior surface an extra branch of six joints. The first joint of this antenna is much stouter than the corresponding joint on the left side. The second about half as long as the first and as stout. The outer half of the anterior border is flattened to receive the first joint of the abnormal branch. From its end arises the regular branch of nine joints, all of which are normal except the first which gives off near the middle of its posterior border a slender spine-like process, half as long as the joint itself, curving outward and backward. The abnormal branch which is composed of six joints is directed forward and outward. The first three joints are flattened and very wide proportionately, the last three cylindrical. The first joint is about as long as the one which bears it and at its base about half as wide as long but considerably wider at tip. The next joint is a little narrower than the tip of the first. Its length about equals its width. The third is one-third narrower than the second and almost twice as long as wide. In the figure it is represented as folded upon itself. The fourth joint is somewhat longer than the third and half as wide, almost twice as long as the fifth which bears the sixth a long slender joint which curves inward and is as long as the fourth and fifth together.

PRIONUS CALIFORNICUS, Motsch.

Fig. 12 represents in a specimen of *Prionus californicus* one of the most remarkable monstrosities that has probably ever occurred among Coleoptera—remarkable not only for extent but also for symmetry. The left maxillary palpus bears two terminal joints. In the right maxillary and the left labial palpi the terminal joint is bifid. Each femur bears two tibiæ furnished with tarsi and claws. The second joint of the left maxillary palpus appears to be composed of two joints closely connate, the anterior one much shorter than the other, each bearing a terminal joint of somewhat unequal lengths, as shown by fig. 12a. The terminal joint of the right maxillary palpus is deeply cleft at apex representing two joints connate at their basal halves; fig. 12b. The terminal joint of the left labial palpus gives off anteriorly from its base a second joint half as long and as stout as the other and connate with it; fig. 12c. The antennæ are normal. The anterior femora are normal in length and in articulation with their coxæ. They gradually widen from base to apex where they are more than twice as wide as a normal femur. Rhomboidal in section; the superior surface about one-third narrower than the inferior. The apices are dilated and deeply notched vertically, making two processes about as long as wide, each containing a normal cotyloid cavity with which the tibiæ are articulated in a normal manner. Fig. 12d, shows the femur and articulations as seen at the end. Of the tibiæ the anterior is somewhat shorter and about two-thirds as stout as the posterior, which is probably the normal one. The spurs, tarsi, and claws of both are similar. The middle femora are normal in length and form but about one-half stouter. The apices each contain one large cotyloid cavity. Into this, which is twice as wide as a normal one, is inserted a single broad condyle formed by coalescence of the condyles of the two tibiæ is shown in fig. 12e. The anterior of these is somewhat shorter and about two-thirds as stout as the posterior. Its tarsi are more slender and a little shorter. The articulation of the tibiæ with the left posterior femur is identical with that of the middle femora; fig. 12e. The anterior of the two tibiæ and its tarsus are about five-sixths the length of the posterior and one-half more slender. In the right posterior femur the articulation with the two tibiæ differs from all the others. The femur itself is about equal in thickness to the left but is a trifle more dilated at apex. This is not notched as in the anterior femora, but truncate. Each tibia is inserted into a distinct cotyloid cavity separated by a considerable interval; fig. 12f. The anterior of the two has been unfortunately broken off about one-fourth of an inch from the femur. The structure of the under side presents no departure from the normal standard.

Collected by Mr. Morrison in Washington Territory.

ELEODES PILOSA, Horn.

In fig. 13 is shown a specimen of *Eleodes pilosa*, the right antenna of which is deformed; the ninth joint bearing on its end two branches of two joints each. Fig. 13a, represents the antenna enlarged. The first seven joints are normal. The eighth and ninth equal each other in length, being slightly shorter than the seventh. The eighth is as wide as long. The ninth at base is as wide as long; at the middle almost twice as wide. From the anterior part of the end arises a branch of two joints which are flattened, almost connate and a little more than half as wide as the ninth joint and as long as wide. The last joint is sinuate at tip. From the posterior part of the end of the ninth joint arises a branch also of two joints which equal in length those of the other branch but are more cylindrical and more nearly resembling normal terminal joints.

From Nevada. In Dr. Horn's Cabinet.

HELOPS SULCIPENNIS, Lec.

Fig. 14 represents an anomaly in the right maxillary palpus of a specimen of *Helops sulcipennis*. Fig. 14a, shows the normal palpus. The anomaly consists in the second joint bearing two terminal joints, one from the outer end of the anterior border and one from the tip. The first joint of this palpus is normal. The second nearly so excepting a dilation and flattening of the anterior border into which the terminal joint is inserted. The latter joint, which in the figure is represented as seen from below, is foreshortened as its plane is nearly perpendicular to the plane of the palpus proper. When viewed from the side it is precisely similar to the terminal joint in fig. 12a. The other joint which arises from the tip of the second is really made up of two joints soldered together at the bases of their broad surfaces. It is consequently twice the thickness of the other terminal joint and at its free edge deeply grooved indicating the union of two joints, and presenting that silky appearance common to the free edge of the normal joint. It is shown in the figure as seen partially from below, partially from the side. The parts shaded are intended to represent the edges of the two joints in one, the dotted part the deep groove.

In Dr. Horn's Cabinet.